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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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VENABLE LLP				
P.O. BOX 34385				
WASHINGTON, DC 20043-9998				
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/554,316

Applicant(s)

CARMAN ET AL.

Examiner

DNYANESH KASTURE

Art Unit

3746

Period for Reply -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 October 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16, 19, 22 and 24-33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-16, 19, 22 and 24-33 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 October 2005 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
- Paper No(s)/Mail Date 24 Oct 05, 24 Feb 06
- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because of the following:

- Reference character "2a" has been used to designate both the actuator body and what appears to be the O-Ring in Figure 1. Also, Page 5 of the specification makes two references to "2a": one for the pump chamber and one for the actuator body.
 - In Figure 1, reference "25" refers to the membrane seat surface but the specification suggests that the surface is dome shaped which is not obvious from the Figure. If the depiction is intentionally flat, the specification needs to say why. It is being shown flat so that the other details can be shown more clearly ?
 - Figure 2 has reference character "4" which points to what appears to be the seating surface of the O-ring, however, the specification suggests that "4" refers to the O-Ring.
 - Reference character "9" refers to the pump chamber in the specification however, in the drawing of Figure 2, "9" appears to refer to the idle chamber since the idler chamber is between the membrane "3" and the lid "1" according to the specification.
2. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate

prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 3, 4, 5, 8, 16, 22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

5. In Re claim 22, the phrase "located towards the perimeter of said dome" is indefinite. Is the "perimeter" everything other than the center or is it just the circumference? If the perimeter is just the circumference, then Figure 4 suggests the outlets are disposed between the inlet and the perimeter, spaced uniformly around the circumference. If the "perimeter" is everything other than the center, then the outlets are located IN the perimeter of the dome.

6. In Re claims 3, 4, 8 and 16 similarly, "towards a perimeter region" is indefinite. An explanation of the differences between "perimeter", "perimeter region", "towards a perimeter" and "towards a perimeter region" is needed.

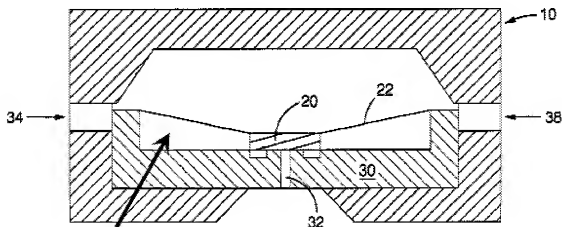
Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1-5, 11, 14-16, 24-28, 30-33 are rejected under 35 U.S.C. 102(b) as being anticipated by Knebel et al (US Patent 5,984,258 A)



pump chamber

FIG. 6

9. In Re claims 1 and 14, with reference to Figure 6 depicted above, Knebel et al discloses an actuation mechanism (title) comprising:

Art Unit: 3746

- an actuator body (10) comprising an actuation chamber (interior space) having a membrane seat surface (30)
- a membrane (22) comprising a shape memory alloy (SMA) that has a martensite-austenite transition temperature (Column 1, Lines 20-32: "...when the alloy is heated above a temperature threshold, the transition temperature, its crystal structure changes to austenite and the alloy returns to its original configuration..")
- said membrane being located over said membrane seat surface as depicted to define a pump chamber between said membrane seat surface and said membrane.
Note that the inlet (34) has a higher diameter than the orifice (32) therefore the velocity of fluid exiting is higher than at entry since the volumetric rate is maintained for an incompressible fluid (fuel), therefore the fluid is "pumped" to a higher velocity.
- said membrane being movable from an undistorted form to a distorted form as stated in Column 4, Lines 1-4: "depending on the original, undeformed configuration of the SMA elements, the valve may be in open position at ambient fuel temperature, and closed upon the application of heat to the SMA elements"
- at least one inlet (34, 38) through which fluid is introduced into the pump chamber
- at least one outlet (32) through which fluid is removed from said pump chamber, said outlet being located at a spaced location from the inlet (outlet is in the center and inlet is at the periphery)
- a bias pressure applicator (Column 4, Lines 33-36 state: "...circulation of fuel across SMA element 22 is effected via flow paths 34, 35, 36 independently of whether

Art Unit: 3746

valve 20 is in an open or closed position across flow metering orifice 32...) that introduces fluid into said pump chamber at a temperature that is below said martensite-austenite transition temperature (in order to provide "forced, convective heat transfer from the SMA element" as stated in Column 3, Lines 33-34, the temperature of the fluid introduced via (34, 36) into the chamber would have to be lower than the transition temperature to cool the SMA)

- a heating system that heats said membrane to an actuation temperature that is above said martensite-austenite transition temperature when said membrane is in said distorted form (Column 4, Lines 17-22 state: "Application of an electrical current to SMA element 22 results in resistance heating, which raises the temperature of SMA element 22 to above the transition temperature. Conversion of the crystal structure to the austenite phase results in the return of element 22 to its undeformed position").

10. In Re claim 25; Column 3, Lines 44-58 of Knebel et al discloses all the claimed limitations.

11. In Re claims 2, 15 and 26, Figure 7 of Knebel et al discloses two outlet locations (38) and (32).

12. In Re claims 3, 4, 16, 27 and 28, Figure 5 of Knebel et al discloses outlets (35) and (36) are located equidistantly around the perimeter, and inlet (34) is in the center.

13. In Re claim 5, Figure 3 of Knebel et al discloses a circular outer perimeter for the membrane seat surface.

14. In Re claim 11 and 24, Knebel et al discloses in Column 4, Lines 17-22 that application of electrical current results in heating.

15. In Re claims 30 and 32, Knebel et al discloses in Column 1, Lines 20-32: "...when the alloy is heated above a temperature threshold, the transition temperature, its crystal structure changes to austenite and the alloy returns to its original configuration...". Since valve element (20) is shown in its normally closed position at ambient fuel temperature before being heated, the fluid entering would have to bias it closed and therefore, it is under sufficient force from the bias applicator to keep element (20) in a closed position thereby deforming the diaphragm. Heating the membrane would return the membrane to the original undeformed position thus lifting element (20). Note also that the weight of the fuel above element (20) is also biasing the element closed.

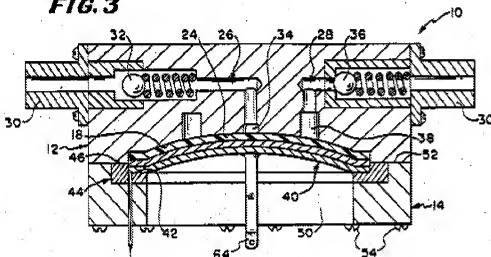
16. In Re claim 31 and 33, when the membrane of Knebel et al is heated, it applies force against the bias of the fluid above it, and the force is greater than the force of the bias pressure applicator in order to lift the element (20).

Claim Rejections - 35 USC § 103

17. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

18. Alternatively, Claims 1, 6-8, 12-14 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brown (US Patent 4,636,149 A) in view of Madurski et al (US Patent 3,606,592 A) and further in view of Knebel et al (US Patent 5,984,258 A)

FIG. 3

19. In Re claims 1 and 14, with reference to Figure 3 depicted above, Brown discloses an actuator body (10) with an actuator chamber (50) and pump chamber between deformable diaphragm/membrane (40) and seat (18), the diaphragm/membrane (40) comprising a bi-metallic element (58) and gasket (60), inlet

(34), bias pressure applicator (32), outlet (38) and heating elements (Column 5, Lines 35-38).

20. However, Brown does not disclose that the membrane comprises a shape memory alloy, introducing fluid at or below the transition temperature and a heating system that heats the membrane to above the transition temperature.

21. Nevertheless, Madurski et al discloses a diaphragm (12) made of shape memory alloy (Nickel – Titanium as stated in Column 2, Lines 30-35) that is used in a fluid pump (title) with a pumping chamber (18) where the fluid flows in from the inlet (22) and is in direct contact with the diaphragm as depicted in Figure 1, before flowing out of the outlet (26).

22. It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the membrane of Brown so it comprises a shape memory alloy in direct contact with the fluid as taught by Madurski et al as an alternate means of actuation that minimizes the number of parts as stated by Madurski et al in Column 1, Lines 47-48.

23. Brown modified by Madurski et al discloses all the claimed limitations except for introducing fluid at or below the transition temperature and a heating system that heats the membrane to above the transition temperature.

24. Nevertheless, Knebel et al, as discussed above discloses that the fluid is introduced below the transition temperature (Column 3, Lines 33-34 and Column 4, Lines 33-36) and a heating system that heats the membrane to above the transition temperature (Column 4, Lines 17-22).

Art Unit: 3746

25. It would have been obvious to a person having ordinary skill in the art at the time of the invention to further modify the pump of Brown modified by Madurski et al so that fluid is introduced below transition temperature and the membrane is heated above the transition temperature as taught by Knebel et al for the purpose of reducing the response time as stated by Knebel et al in Column 2, Lines 24-25.

26. In Re claim 6, Madurski et al discloses that the dome shaped wall of chamber (18) is a dome shaped seat extending inwardly into the actuation chamber (since it is a recess, it extends inwardly). Note that chamber (20) also has a dome shaped surface.

27. In Re claim 7, Brown discloses that the inlet (34) is located in the center of the dome.

28. In Re claim 8, Brown discloses that the outlet (38) is located towards the perimeter of the dome.

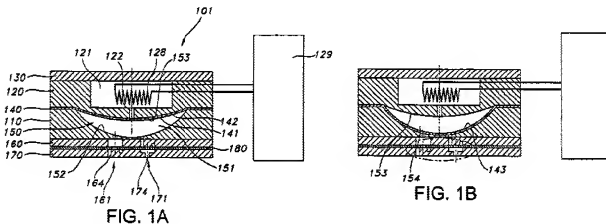
29. In Re claim 12, Brown discloses inlet pressure check valve (32).

30. In Re claim 13, Brown discloses outlet pressure check valve (36).

31. In Re claim 29, Madurski et al suggests in Column 3, Lines 50-55 that a double acting pump is possible as shown in Figure 4 with a pair of chambers such as shown in

Figure 1 as (18) and (20). Note that it has been held that mere duplication of essential working parts of a device involves only routine skill in the art - MPEP 2144.04 (VI-B).

32. Claims 6-8 (Alternatively) and claims 9, 10, 19, 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brown (US Patent 4,636,149 A) in view of Madurski et al (US Patent 3,606,592 A) and in view of Knebel et al (US Patent 5,984,258 A) and further in view of Hansen (US Patent 6,948,918 B2)



33. In Re claim 6 and 19, Brown, Madurski et al and Knebel et al as applied to claim 1 disclose all the claimed limitations except for a dome shaped PROTRUSION extending into the actuation chamber, the protrusion acting as a seat for the membrane.

34. Nevertheless with reference to Figures 1A and 1B depicted above, Hansen discloses a dome shaped protrusion (153) extending into the pump chamber (formed between surface (143) of the membrane and the dome, the pump chamber is a part of the actuation chamber). The dome shape is a seat for the membrane.

35. It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the membrane seat of Brown so it is a dome shaped protrusion as taught by Hansen instead of the recess as disclosed by Brown, for the purpose of ensuring well defined end positions for the membrane as suggested by Hansen in Column 3, Lines 60-61.

36. In Re claim 22, Figure 5 of Knebel et al discloses outlets (35) and (36) are located equidistantly around the perimeter and inlet (34) is in the center.

37. In Re claim 7, Hansen discloses an inlet passage for the fluid to flow into the pump chamber located in the center of the dome.

38. In Re claim 8, Hansen discloses in Column 5, Lines 9-27 disclose that the shape of the dome can be a portion of a sphere which has a circular perimeter. Figure 5 of Knebel et al discloses outlets (35) and (36) are located equidistantly around the perimeter and inlet (34) is in the center.

39. In Re claim 9, Figure 7 of Knebel et al discloses two outlet locations (38) and (32). Note also that Brown discloses an annular port continuously formed around the circumference connected to the outlet by a linear passageway however, since it has been held that constructing a formerly integral structure in various elements involves only routine skill in the art (MPEP 2144.04 (V-C)), it would be obvious to one of ordinary

skill to form a plurality of passages distributed uniformly around the circumference connected by a linear passageway.

40. In Re claim 10, Figure 5 of Knebel et al discloses outlets (35) and (36) are located equidistantly around the perimeter and inlet (34) is in the center.

Conclusion

41. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Knebel et al (PG Pub US 20020130284 A1) discloses directional impingement of fluid streams in different configurations for cooling the membrane. Knapp (US Patent 5,507,314 A) discloses a ball that can be a seat having with three outlet passages disposed around uniformly around the circumference. McCausland (US Patent 5,435,152 A) discloses another diaphragm that is cooled by refrigerant.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DNYANESH KASTURE whose telephone number is (571)270-3928. The examiner can normally be reached on Mon-Fri, 9:00 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Devon Kramer can be reached on (571) 272 - 7118. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Devon C Kramer/
Supervisory Patent Examiner, Art
Unit 3746

DGK